

FIG. 1

44

Main

Joint

Current Procedure

New Procedure

Plant Usage

Print

Set-up

Tools

Knowledge Base

Improvement Potential

Joint Information

Weld Joints

Please choose Type of Weld Joint :

Groove - Double V

Groove Weld Joint

Base Material Thickness (T1)	0.5	in
Top Included Angle (A1)	60	degrees
Root (Gap) Opening (R)	0.125	in
Land Thickness (L)	0.1	in
Top (Cap) Build-up (B1)	0.1	in
Base Material Thickness (T2)	0.5	in
Bottom Included Angle (A2)	60	degrees
Bottom (Root) Build-up (B2)	0.1	in

Calculate Area

54

Reset

58

Weld Joint Calculated Values

Cross Section Area (CSA) 0.446 in²

Weight per unit length of weld 1.516 lb/ft

2 / 20

FIG. 2

Procedure Summary — New Procedure									
Main Joint		Current Procedure		New Procedure		Plant Usage		Print Set-up Tools Knowledge Base Improvement Potential	
General Information									
64 Description ABC Company - Double V Groove Weld Example		PQR # / Procedure # DBLV-001		Total # of Weld Passes 70		Power Supply Efficiency 75 %			
Total length of weld joint ft 100		Power Rate \$/kWh 0.08		Labor & Overhead Rate \$/hr 66					
New Procedure									
124 Number of Weld Passes 126 Welding Process		Process 1 124 1		Reset		Process 2 122 0		Reset	
128 Operator Factor 130 Electrode Brand Name		0 %		0 %		0 %		0 %	
132 Electrode Classification 134 Type of Gas / Flux									
136 Deposition Efficiency Gas Flow or Flux Ratio		0 % c.f.h.		0 % c.f.h.		0 % c.f.h.		0 % c.f.h.	
140 Electrode Diameter Welding Voltage		0 in volts		0 in volts		0 in volts		0 in volts	
144 Wire Feed Speed Electrode Stick-out		0 in/min in		0 in/min in		0 in/min in		0 in/min in	
148 Welding Current Welding Travel Speed		0 amps in/min		0 amps in/min		0 amps in/min		0 amps in/min	
154 Electrode 156 Gas or Flux		0 \$/lbs 0 \$/#3		0 \$/lbs 0 \$/#3		0 \$/lbs 0 \$/#3		0 \$/lbs 0 \$/#3	
160 Pre-weld Time Post-weld Time		0 hrs 0 hrs		0 hrs 0 hrs		0 hrs 0 hrs		0 hrs 0 hrs	
Additional Variable Costs		0 \$		0 \$		0 \$		0 \$	
Reset Procedure									
Deposition									
View Summary									

44

Print

Main

Joint

Current Procedure

New Procedure

Plant Usage

Print

Set-up

Tools

Knowledge Base

Improvement Potential

Weld Procedure Summary

Print Choice

☐ Header

☐ Executive Summary

☐ Weld Joint Detail Report

☐ Welding Procedure Detail Report

☐ Weld Procedure Summary

☐ Welding Procedure Comparison Summary

☐ Summary Graphs

194

194

Check All

Print Reports

Produce Excel File

Click the "Start Building" button to build the excel file ...

196

Start Building

Improvement Potential

Print Choice

☐ Improvement Potential Process Map

☐ Improvement Potential Checklist

200

202

Check All

Print Reports

Produce Excel File

Click the "Start Building" button to build the excel file ...

204

Start Building

190

42

192

FIG. 6

Knowledge Base 44

Main

Joint

Current Procedure

New Procedure

Plant Usage

Print

Set-up

Tools

Knowledge Base

Improvement Potential

Data Sheets

FCAW - Hobart XL71 (english)

208

210

Get Data Sheet

Miscellaneous Information Sheets

HBC Material Safety Data Sheet - Tubular (english)

212

214

Get Information

Articles

HBC Material Safety Data Sheet - Tubular (french)

216

218

Get Article

FIG. 7

Improvement Potential 44

Pre-Weld Activities

#	Activity Name	Comments	Cycle Time (min)	Current	IP %	Potential
1	Part Movement	a123	230	10	46	5.4
2	Loading Unloading Plate Cutting Shot Blasting Fit/Tack Fixturing Grinding / Buffing Pre-Heating Pre-Cambering Anti-Spatter Application Repair / Re-work	b123	232	20	20	16
3		c123		30	30	21
4		d123		40	40	24
5		e123		50	50	25
6		f123		60	60	24
7	Fixturing	g123		70	70	21
8	Grinding / Buffing	h123		80	80	16
9	Pre-Heating	i123		90	90	9
10	Pre-Cambering	j123		100	95	5

222

224

226

228

Time Units:

$$\frac{F}{G} \infty$$

42

240

248

250

242

244

246

252

254

256

258

260

Combo	Process	Dia (Imp)	Dia (met)	WFS (Imp)	WFS (met)	ESO (Imp)	ESO (met)	Amps	Shield Gas
FCAWAr / 25%CO20.0453500.5	FCAW	0.045	1.2	350	8.9	0.50	12.7	220	Ar / 25% CO2
FCAWAr / 25%CO20.0453750.5	FCAW	0.045	1.2	375	9.5	0.50	12.7	230	Ar / 25% CO2
FCAWAr / 25%CO20.0454000.5	FCAW	0.045	1.2	400	10.2	0.50	12.7	240	Ar / 25% CO2
FCAWAr / 25%CO20.0454250.5	FCAW	0.045	1.2	425	10.8	0.50	12.7	250	Ar / 25% CO2
FCAWAr / 25%CO20.0454500.5	FCAW	0.045	1.2	450	11.4	0.50	12.7	260	Ar / 25% CO2
FCAWAr / 25%CO20.0454750.5	FCAW	0.045	1.2	475	12.1	0.50	12.7	270	Ar / 25% CO2
FCAWAr / 25%CO20.0455000.5	FCAW	0.045	1.2	500	12.7	0.50	12.7	280	Ar / 25% CO2
FCAWAr / 25%CO20.0455250.5	FCAW	0.045	1.2	525	13.3	0.50	12.7	290	Ar / 25% CO2
FCAWAr / 25%CO20.0455500.5	FCAW	0.045	1.2	550	14.0	0.50	12.7	300	Ar / 25% CO2
FCAWAr / 25%CO20.0453500.75	FCAW	0.045	1.2	350	8.9	0.75	19.1	200	Ar / 25% CO2

FIG. 9

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264		266	268	270	272	274	276	278	280	282
Note : Ensure consumable name matches tab A consumable name.		Consumable Name	Diameter (Imp)	Diameter (Metric)	Voltage	Recommended Parameters - Imperial		Recommended Parameters - Metric		
Combo						WFS	ESO	WFS	ESO	Current
Hobart Fabcor 96Ar / 15% CO20.045		Hobart Fabcor 96	0.045	1.2	26.0	575	0.50	14.6	12.7	300
Hobart Fabcor 96Ar / 15% CO20.052		Hobart Fabcor 96	0.062	1.4	27.5	400	0.75	10.2	19.1	320
Hobart Fabcor 96Ar / 15% CO20.062		Hobart Fabcor 96	0.062	1.6	28.0	325	0.75	8.3	19.1	400
Hobart XL-71Ar / 25% CO20.045		Hobart XL-71	0.045	1.2	27.5	525	0.50	13.3	12.7	290
Hobart XL-71Ar / 25% CO20.052		Hobart XL-71	0.052	1.4	25.5	450	0.75	11.4	19.1	305
Hobart XL-71Ar / 25% CO20.062		Hobart XL-71	0.062	1.6	27.0	275	0.75	7.0	19.1	375
Hobart FabDual T91MAr / 25% CO20.045		Hobart FabDual T91N	0.045	1.2	25.0	450	0.50	11.4	12.7	275
Hobart FabDual T91MAr / 25% CO20.052		Hobart FabDual T91N	0.052	1.4	26.0	350	0.63	8.9	16.0	325
Hobart FabDual T91MAr / 25% CO20.062		Hobart FabDual T91N	0.062	1.6	27.0	275	0.75	7.0	19.1	375
Hobart RXR 100% CO20.062		Hobart RXR	0.062	1.6	28.0	275	0.75	7.0	19.1	375
Hobart RXR 100% CO20.078		Hobart RXR	0.078	2.0	29.0	250	1.00	6.4	25.4	425
Hobart RXR 100% CO20.094		Hobart RXR	0.094	2.4	30.0	200	1.00	5.1	25.4	475
Eclipse RXR-XLS 100% CO20.062		Eclipse RXR-XLS	0.062	1.6	28.0	275	0.75	7.0	19.1	375
Eclipse RXR-XLS 100% CO20.078		Eclipse RXR-XLS	0.078	2.0	29.0	250	1.00	6.4	25.4	425
Eclipse RXR-XLS 100% CO20.094		Eclipse RXR-XLS	0.094	2.4	30.0	200	1.00	5.1	25.4	475
Hobart FabDual T9M100% CO20.062		Hobart FabDual T9M	0.062	1.6	28.0	275	0.75	7.0	19.1	375
Hobart FabDual T9M100% CO20.078		Hobart FabDual T9M	0.078	2.0	29.0	250	1.00	6.4	25.4	425
Hobart FabDual T9M100% CO20.094		Hobart FabDual T9M	0.094	2.4	30.0	200	1.00	5.1	25.4	475
BR-6Ar / 8-10% CO20.052		BR-6	0.052	1.4	28.0	425	0.50	10.8	12.7	290

FIG. 10

Key Account Management (KAM) Summary Report

Executive Summary

We have performed a process analysis of the following weldment :

Description : **TANK END WELDS AND SEAM**

PQR # / Procedure # : **test**

We have determined that a number of cost and quality drivers should be evaluated

- **Total metal deposited : to evaluate any overweld / underweld conditions**
- **Total cycle time (including pre-weld, post-weld, and welding time) : to evaluate plant capacity increase potential**
- **Heat input analysis : to determine if distortion reduction potential is possible**
- **Total process cost : to determine if a new process will reduce to the total process cost**

Our analysis highlights the following opportunities for improvement :

Total Metal Deposited

Our analysis indicates that the net difference of total metal deposited between the current procedure and the new procedure is approximately : 0 lbs [0 %] 286

- * **The new procedure is producing a weld deposit which matches that required by the joint dimensions**
- ** **The original procedure is producing a weld deposit which matches that required by the joint dimensions**

Total Cycle Time

Our analysis indicates the potential capacity that may be available by converting to the new process will be approximately : 2.64 hrs [54.5 %] per weld joint 288

- * **The new procedure provides the opportunity to increase throughput**

Heat Input Analysis

Our analysis indicates that the total heat input difference between the current process and the new process is approximately : 5.74 kJ/in [30 %] 290

- * **The new procedure provides the opportunity to reduce overall heat input (reduce distortion)**

Total Process Cost

Our analysis indicates that the total process cost difference between the current process and the new process is approximately : \$ 162.5 [54.1 %] per weld joint 292

The new procedure provides significant reductions (greater than 10%) in the following areas :

294

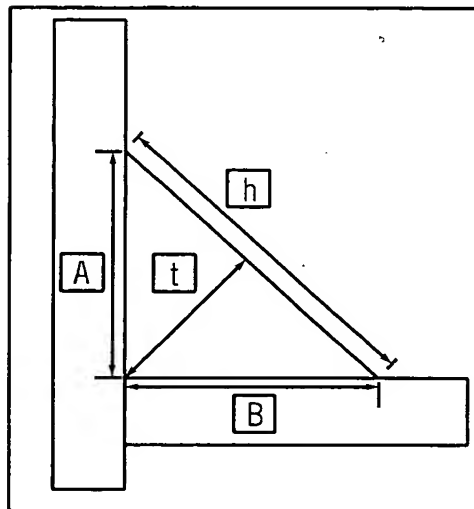
WELD JOINT DETAIL REPORT

GENERAL INFORMATION

JOINT TYPE FILLET-FLAT
 CROSS SECTION AREA (CSA) 0.021 in²
 TOTAL LENGTH OF WELD JOINT 33ft

298

WELD JOINT GRAPHIC DETAIL



LEG LENGTH (A) 0.187 in
 LEG LENGTH (B) 0.187 in
 THEORETICAL EFFECTIVE THROAT (t) 0.132 in

296

298

FIG. 12

300

13 / 20

FIG. 13

Welding Procedure Detail Report

General Information

Description TANK END WELDS AND SEAM
 PQR # / Procedure # test
 Total length of weld joint 33 ft
 Labor & Overhead Rate 60 \$/hr
 Power Rate 0.08 \$/kWh
 Power Supply Efficiency 75 %

Welding Procedure Detail

Current Procedure

Total # of Weld Passes

1

72

Procedure Variables Information

Number of Weld Passes
 Welding Process
 Operating Factor { % }
 Electrode Brand Name
 Electrode Classification
 Type of Shielding Gas
 Gas Flow Rate { cfh }
 Deposition Efficiency { % }
 Electrode Diameter { in }
 Welding Voltage { volts }
 Wire Feed Speed { in/min }
 Electrode Stick-out { in }
 Welding Current { amps }
 Welding Travel Speed { in/min }

1
 MCAW-Manual
 30
 Custom - MCAW
 CSA E4801C-6-CH
 Ar / 8-10% CO2
 40
 91
 0.045
 28.0
 300
 0.50
 195
 18.88

302

104

Theoretical Deposition Rate { lbs/hr }
 Actual Deposition Rate { lbs/hr }

7.45
 2.03

Consumable Cost Information

Electrode Cost { \$/lbs }
 Shielding Gas Cost { \$/ft3 }

2.00
 0.10

Additional Information

Pre-weld Time { hrs }
 Post-weld Time { hrs }
 Additional Variable Costs { \$ }

2.08
 1.60
 3.00

Description see IP TAB

Description see IP TAB

Description grinding disks, spatter spray

New Procedure

Total # of Weld Passes

1

120

Procedure Variables Information

Number of Weld Passes
 Welding Process
 Operating Factor { % }
 Electrode Brand Name
 Electrode Classification
 Type of Shielding Gas
 Gas Flow Rate { cfh }
 Deposition Efficiency { % }
 Electrode Diameter { in }
 Welding Voltage { volts }
 Wire Feed Speed { in/min }
 Electrode Stick-out { in }
 Welding Current { amps }
 Welding Travel Speed { in/min }

1
 MCAW-Manual
 30
 Corex 6XC
 CSA E4801C-6-CH
 Ar / 2-5% O2
 40
 97
 0.052
 26.0
 450
 0.75
 300
 40.31

304

Theoretical Deposition Rate { lbs/hr }
 Actual Deposition Rate { lbs/hr }

14.93
 4.34

Consumable Cost Information

Electrode Cost { \$/lbs }
 Shielding Gas Cost { \$/ft3 }

2.00
 0.10

Additional Information

Pre-weld Time { hrs }
 Post-weld Time { hrs }
 Additional Variable Costs { \$ }

1.66

158

Description see IP TAB

Description see IP TAB

Description see IP TAB

FIG. 14

306

Weld Procedure Summary

Customer

Weld Metal Deposition Summary

Joint Information

Joint Type
Total length of weld joint

Fillet - Flat
33 ft

Cross Section Area (CSA) 0.021 in2

Current Procedure

New Procedure

Total	Weld Metal Deposited [lbs]	Weld Metal Required by Weld Joint [lbs]	Overweld (Underweld)	Cycle Time	Pre-weld Time [hrs]	Post-weld Time [hrs]	Total Welding Time [hrs]	Cycle Time [hrs]	Heat Input Summary	Heat Input [kJ/in]	Weld Consumable Usage Summary	Electrode Consumed [lbs]	Shielding Gas Consumed [ft3]	Power Consumed [kWh]	Procedure Cost	Pre & Post Weld Labor [\$]	Welding Labor [\$]	Total Electrode [\$]	Total Shielding Gas [\$]	Power [\$]	Additional Variable Expense(s) [\$]	Procedure / Process Total Cost
2.37	2.37	2.37	0.0%	2.08	1.60	1.17	4.85	17.4	2.61	13.98	2.54	220.80	69.92	5.21	1.40	0.20	3.00					\$300.53

308	Weld Metal Deposited [lbs]	Weld Metal Required by Weld Joint [lbs]	Overweld (Underweld)	Cycle Time	Pre-weld Time [hrs]	Post-weld Time [hrs]	Total Welding Time [hrs]	Cycle Time [hrs]	Heat Input Summary	Heat Input [kJ/in]	Weld Consumable Usage Summary	Electrode Consumed [lbs]	Shielding Gas Consumed [ft3]	Power Consumed [kWh]	Procedure Cost	Pre & Post Weld Labor [\$]	Welding Labor [\$]	Total Electrode [\$]	Total Shielding Gas [\$]	Power [\$]	Additional Variable Expense(s) [\$]	Procedure / Process Total Cost
310	2.37	2.37	0.0%	1.66	0.55	2.21	11.6	2.44	6.55	1.70	99.60	32.75	4.89	0.65	0.14							\$138.03

Note : Numbers shown on this report are estimates only, any changes will modify the results

Welding Procedure Comparison Summary

Customer

Procedure Summary

Description TANK END WELDS AND SEAM

PQR # / Procedure # test

Joint Type Fillet - Flat

Weld Metal Required by Weld Joint 2.37 lbs

336

Cross Section Area (CSA) 0.021 in²

Total length of weld joint 33 ft

338

per 100 lbs deposited metal	
Current Procedure	New Procedure

Not Applicable
Weld Deposit Difference Exceeds 10%

per weld joint	
Current Procedure	New Procedure

2.37 lbs 2.37 lbs

0.01% 0.00%

2.08 hrs 1.66 hrs

1.60 hrs 0.55 hrs

1.17 hrs 2.21 hrs

4.85 hrs 2.64 hrs

54.5 %

Potential Capacity Increase

Consumption Summary

Electrode Consumed

Shielding Gas Consumed

Power Consumed

Heat Input Summary

Welding Cost Analysis Summary

Total Cost Summary

Pre & Post Weld Labor

Welding Labor

Total Labor

Total Electrode

Total Shielding Gas

Power

Additional Variable Expense(s)

Total Process Cost

Potential Production Cost Savings

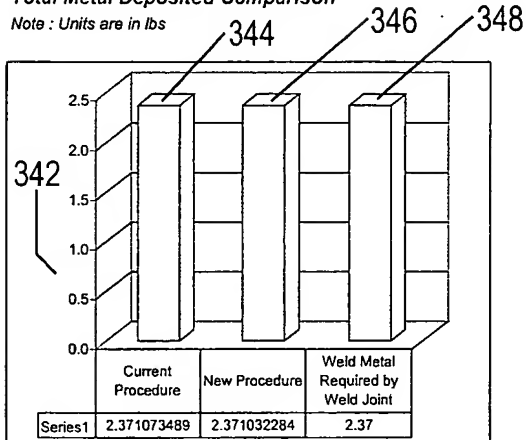
Note : Numbers shown on this report are estimates only, any changes will modify the results

FIG. 15

SUMMARY GRAPHS

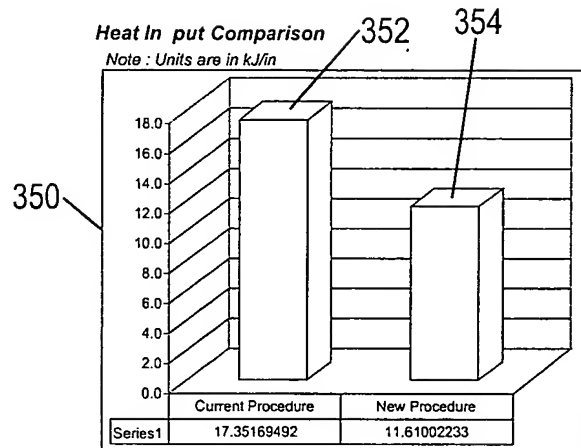
Total Metal Deposited Comparison

Note : Units are in lbs



Heat Input Comparison

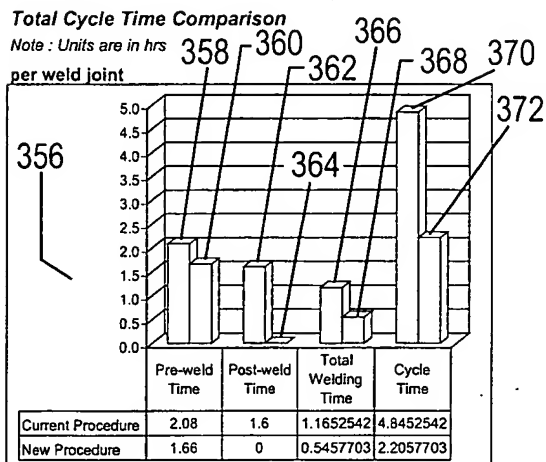
Note : Units are in kJ/in



Total Cycle Time Comparison

Note : Units are in hrs

per weld joint



Total Process Cost Comparison

Note : Units are in \$

per weld joint

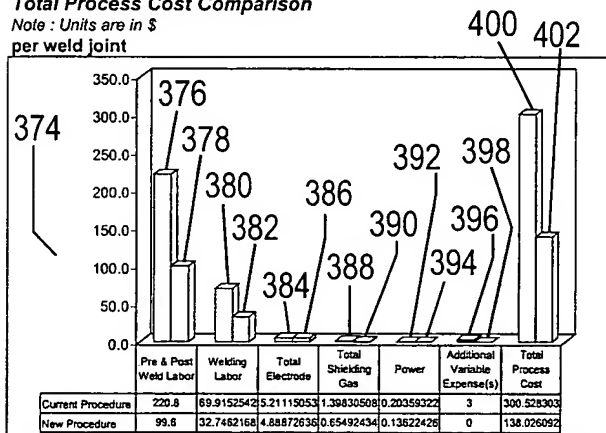


FIG. 16

Improvement Potential Process Map

Pre-Weld Activities

Coming From ...

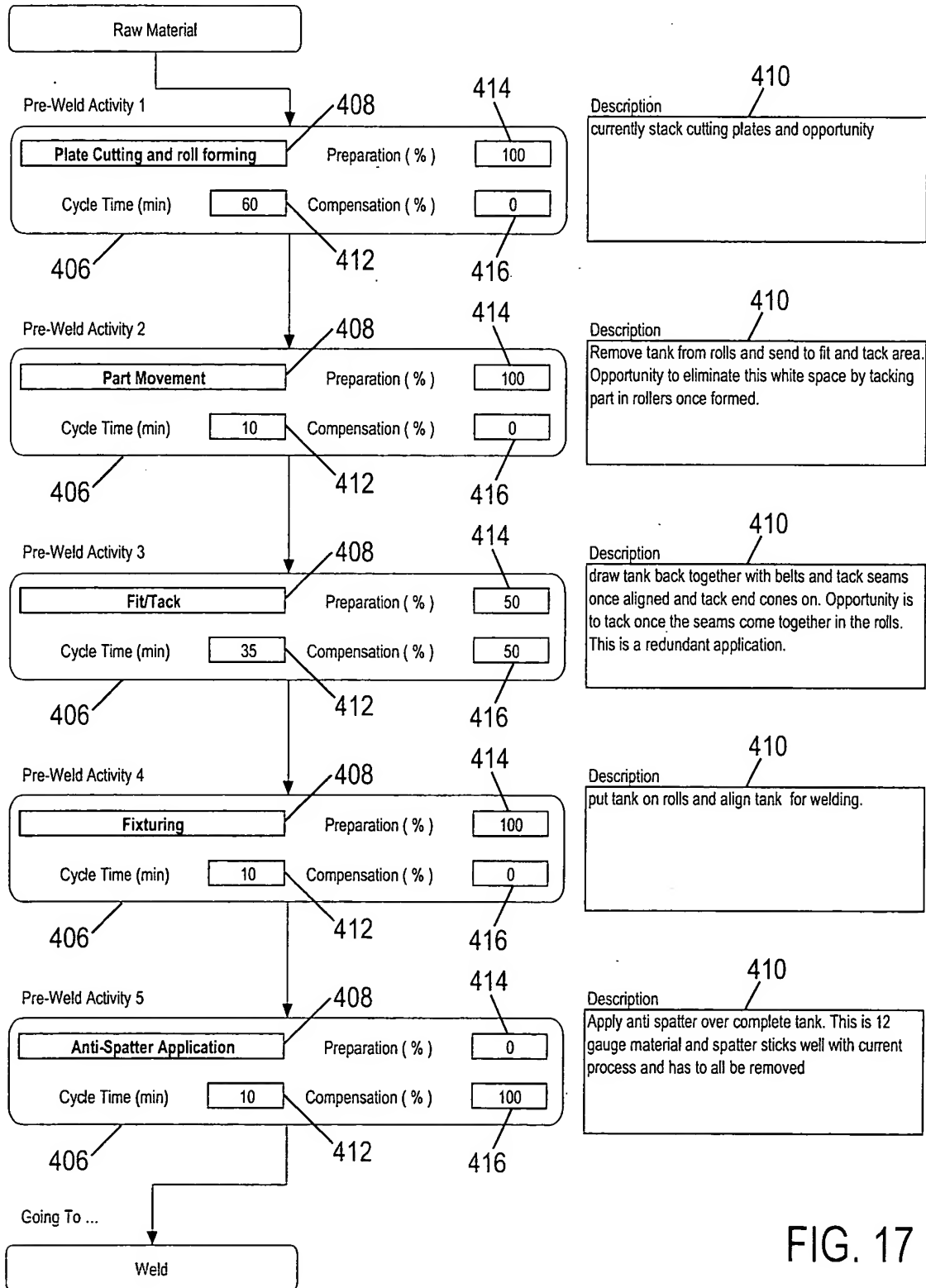
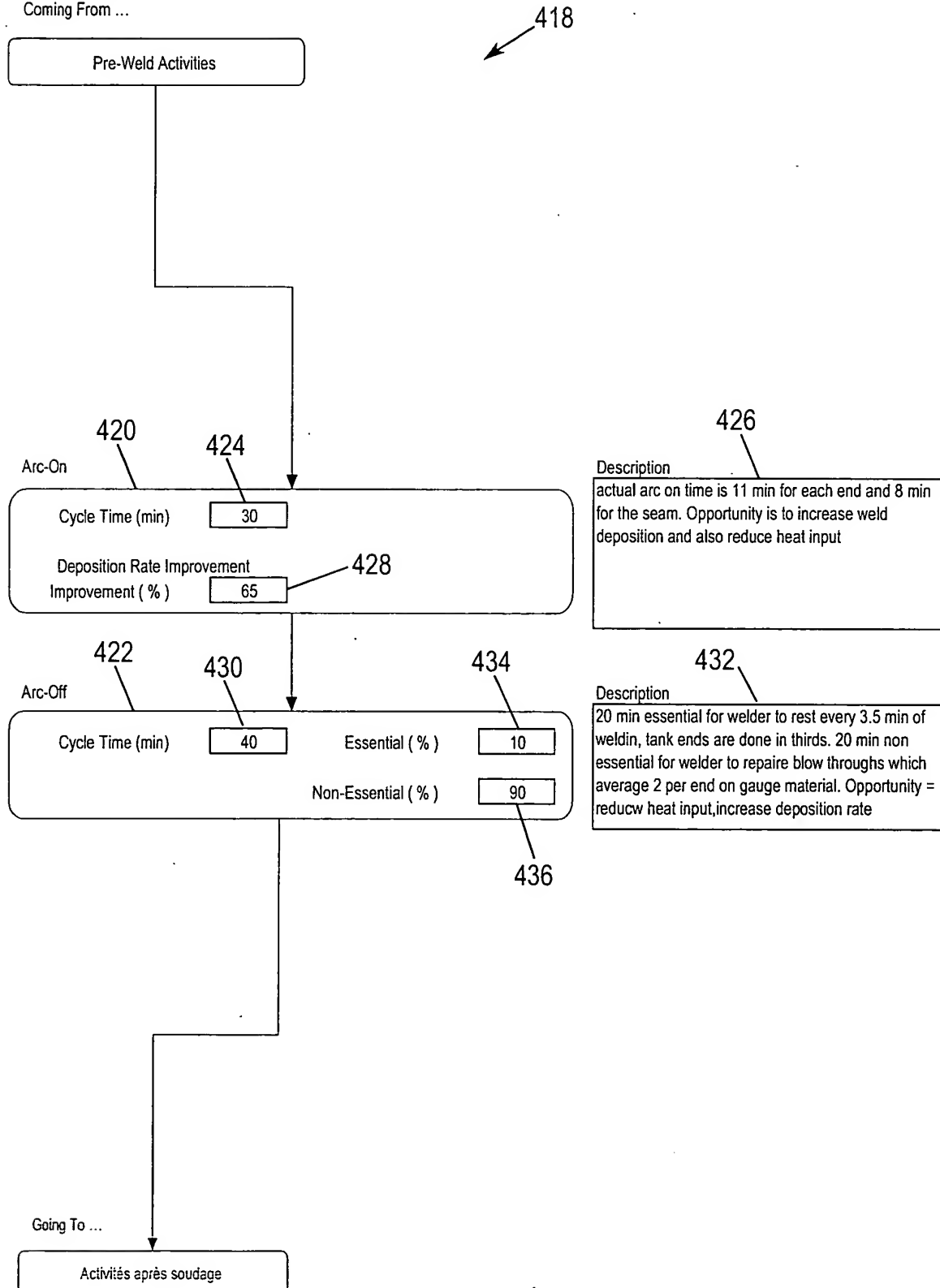


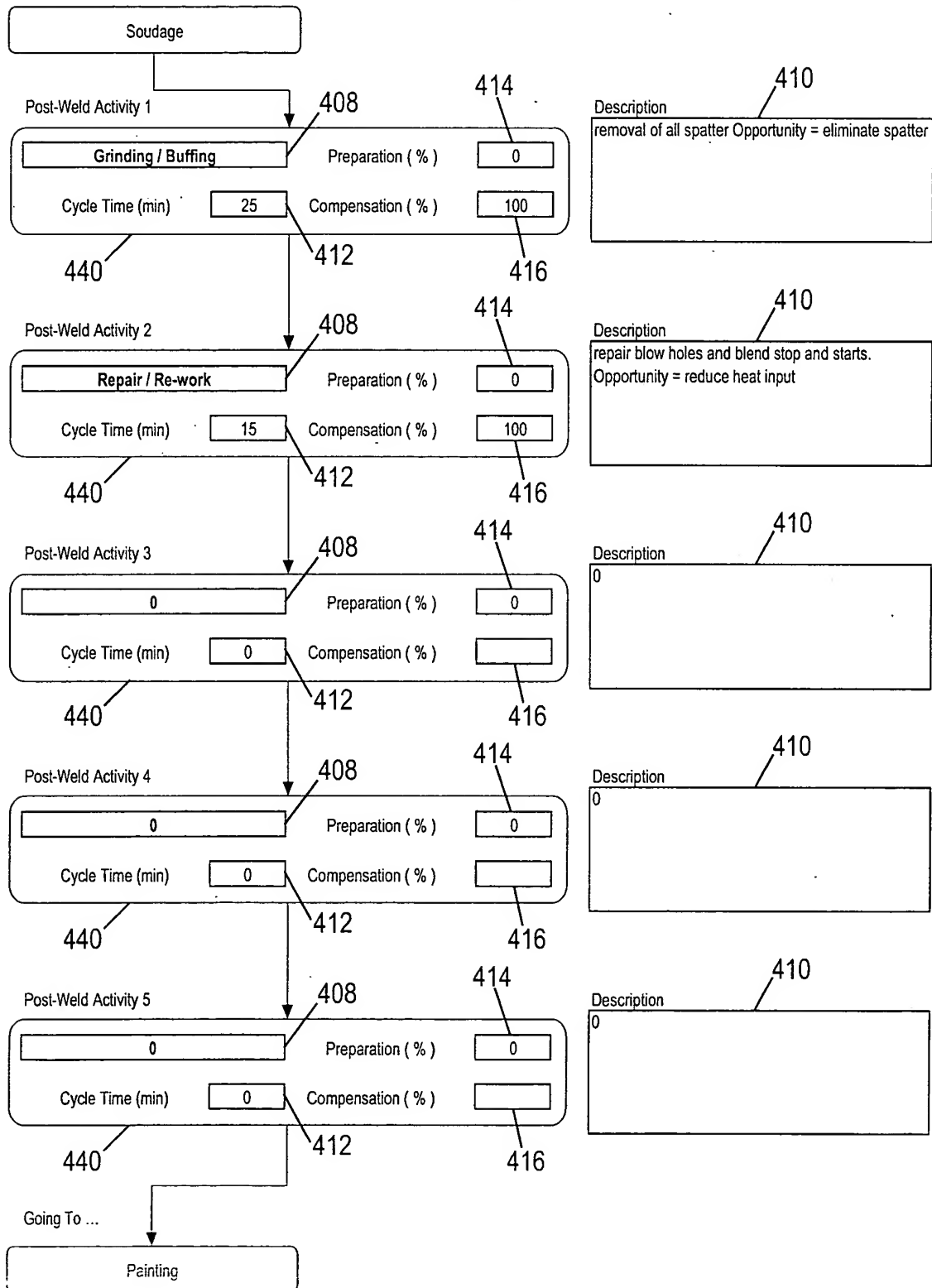
FIG. 17

Weld Activity

Coming From ...



Coming From ...



444 446 450 Improvement Potential Checklist 452 456

Activity Name	Current (min)	IP %	Potential (min)	Description
Pre-Weld Activities				
1 Plate Cutting and roll forming	60.0	0	60.0	currently stack cutting plates and opportunity
2 Part Movement	10.0	0	10.0	Remove tank from rolls and send to fit and tack area. Opportunity to eliminate this while space by lacking part in rollers once formed.
3 Fit/Tack	35.0	50	17.5	draw tank back together with bells and tack seams once aligned and tack end cones on. Opportunity is to tack once the seams come together in the rolls. This is a redundant
4 Fixturing	10.0	0	10.0	put tank on rolls and align tank for welding.
5 Anti-Spatter Application	10.0	100	0.0	Apply anti spatter over complete tank. This is 12 gauge material and spatter sticks well with current process and has to all be removed
6	0.0		0.0	0
7	0.0		0.0	0
8	0.0		0.0	0
9	0.0		0.0	0
10	0.0		0.0	0
Weld Activities				
Arc-On	30.0	0	18.2	actual arc on time is 11 min for each end and 8 min for the seam. Opportunity is to increase weld deposition and also reduce heat input
Arc-Off	40.0	90	4.0	20 min essential for welder to rest every 3.5 min of weldin, tank ends are done in thirds. 20 min non essential for welder to repair blow throughs which average 2 per end on
Post-Weld Activities				
1 Grinding / Buffing	25.0	100	0.0	removal of all spatter Opportunity = eliminate spatter
2 Repair / Re-work	15.0	100	0.0	repair blow holes and blend stop and starts. Opportunity = reduce heat input
3	0.0		0.0	0
4	0.0		0.0	0
5	0.0		0.0	0
6	0.0		0.0	0
7	0.0		0.0	0
8	0.0		0.0	0
9	0.0		0.0	0
10	0.0		0.0	0
Total	235.0		119.7	Overall cycle time improvement potential of 49.1 %

FIG. 20